PAINTING CONCRETE SURFACES

Choice of correct paint type and proper surface preparation are the essentials for a lasting paint job over concrete. Here is a fast-reading review of some first principles.

FOR MANY STRUCTURES the visual appearance of good-quality, well-compacted site-cast concrete is entirely adequate. Frequently, however, the client (or his architect) specifies a final paint treatment; this may be for protective purposes or simply to obtain a desired color or finish. The actual paint job may or may not be the responsibility of the concrete contractor, but either way the quality of the surface after the forms have been stripped has a major influence on the durability of the paint coat and its appearance.

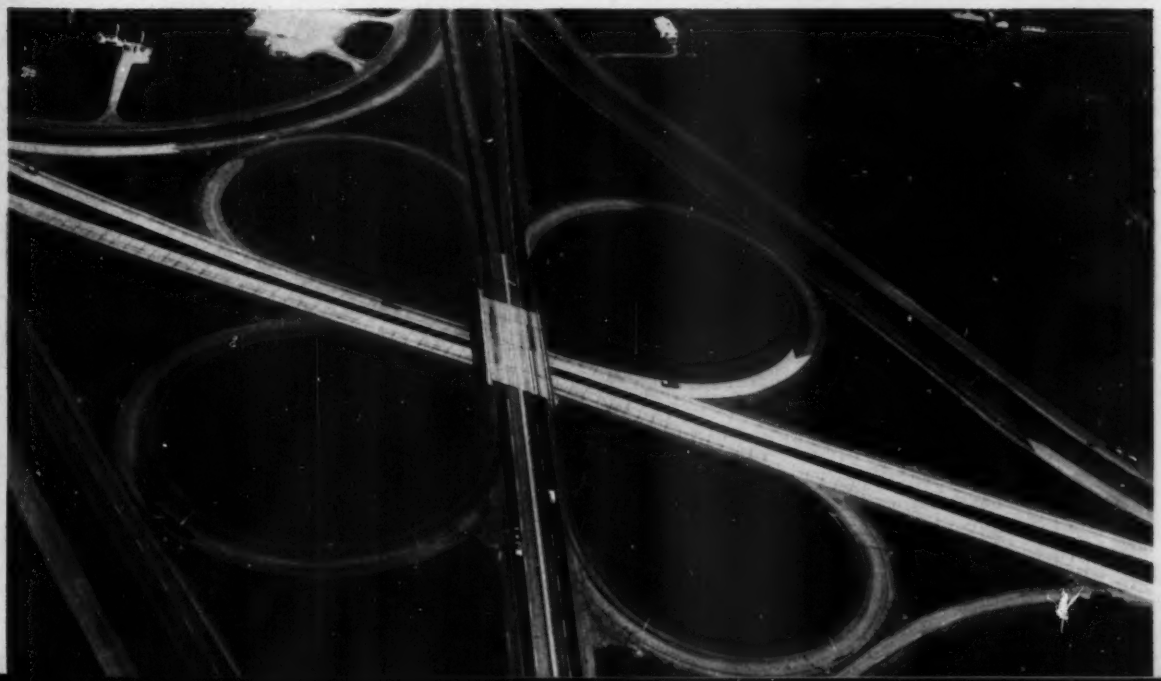
PAINT SELECTION

There are literally hundreds of paints offered for use on concrete, and selecting the correct one for a particular application on the basis of a brand name alone is just about impossible. Experience, as always, can be a good guide. Personal knowledge of a paint that has performed well in a certain exposure is a good recommendation for its use under similar conditions. The advice of reputable dealers is worth seeking; few paint manufacturers are willing to risk their reputations on poor performance for the sake of a quick sale.

However, a knowledge of the basic composition of a paint is the safest method of assessing its application potential. In general seven main types can be distinguished; recommended usage and characteristics are given in the accompanying table. Usually it is possible to determine the type from the label on the can, although most companies also provide their sales engineers with comprehensive notes. In general with good-quality paints of the same type there will be little difference in performance (or cost) due to minor variations in composition. The type of concrete surface is also of little importance; the paints will perform equally well on site-cast concrete, precast units, cement mortar and plaster, stucco and asbestos-cement products. The problem essentially is to select the correct type for the particular exposure conditions and to apply it properly.

An expensive paint does not necessarily guaran-

Reflective coating materials are being used experimentally on modern concrete highways. The ramp surfaces of the two upper quadrants in this picture are designed to distinguish by color, brightness and location the exact position of ramps, merging areas and through lanes. Turnoffs and exit ramps are blue; on-ramps and points of merging traffic are yellow. The materials used on this project have a major effect upon night time visibility.



FILE: Finishing

tee a good job. However, since expenditure on materials will not usually exceed 25 percent of the total cost of the paint job, a saving of a few dollars on paint may prove false economy if it leads to an early failure.

THE PAINT TYPES

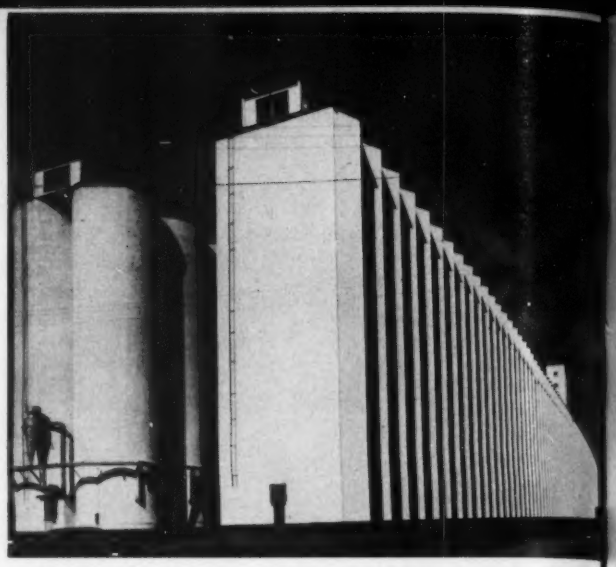
Cement-water paints consist of portland cement, usually white, ground together with several other components. Hydrated lime and water repellents are included; limeproof and sunlight resistant pigments provide the desired color. The ratio of portland cement to other ingredients is seldom less than 1 to 1, and may be as high as 9 to 1; the usual ratio is however about 3 to 1.

The product is sold in dry powder form to be mixed with water before applying. The big advantage of cement-water paints is, of course, that they can be applied directly to a damp surface—in fact, to be successful, the surfaces must be wetted thoroughly before application.

The precise amount of mixing water to be used with these paints depends on the fineness of the ground materials. A consistency of rich cream is recommended, with the first coat being slightly thinner; this will normally require 3¼ to 4¼ quarts of water for 10 pounds of fine-ground dry powder and 2 to 2½ quarts for 10 pounds of coarse-ground powder. It is good practice to use about half the required water for mixing and then to add the remainder to obtain the desired consistency. Workability improves by allowing the paint to stand for between 30 and 45 minutes. A disadvantage is that the paints begin to stiffen after about 3 to 4 hours, or even less in hot weather. The consistency can be restored with extra water, but this tends to alter the color and there is also a serious risk of incurring shrinkage cracks.

Oil-base paints are the conventional type commonly used in home construction for woodwork exposed to the weather. They consist basically of a drying oil (usually linseed), thinners, pigments and driers. For use on concrete the paints are often fortified by the addition of a small proportion of a special resin or treated oil, to give added alkali resistance. The container label should indicate that the paint can be used on masonry. Some manufacturers also recommend the use of a separate fortified primer, for example where the concrete is subject to dampness, in order to improve alkali resistance. In general, however, concrete, unlike steel or lumber, does not need special priming paints.

Oil-base paints present initially a glossy surface; they are so formulated however as to chalk with age. The purpose of this is to give a continually clean and attractive surface by shedding dirt and mildew; thus the paint film erodes until it is so thin that it no longer provides adequate protection. The rate of chalking is increased by intense sunshine and rainfall, so that chalking is particularly heavy in the Southeastern and Gulf states and less severe in the dry, hot climate of the Southwest. Chalking is not itself a fault and should not be confused with efflorescence, which is the exudation of a deposit of salts (usually white) from the mass of the concrete. In fact, chalking is a manifestation of gradual wearing away of the coating, thereby producing a surface suitable for a repainting without expensive surface preparation.



A single coat of 6000 gallons of specially formulated masonry paint provides beauty and essential protection against the elements for this quarter-mile long grain elevator. The paint, based on a synthetic rubber resin, required no prior preparation of the concrete surface because it is itself a curative.

Oil paints, both the straight and fortified variety, provide an effective barrier against the penetration of rain water. Neither of them is suitable for prolonged exposure to water or for use where moisture will continue to reach the paint from the interior of the concrete. They are not sufficiently abrasion resistant or adhesive for use on floors.

Varnish-base paints generally consist of a varnish made with resins, oils, solvents, driers, and thinners and pigmented for color and improved performace. They are marketed in grades of flat, eggshell, semi-gloss, full-gloss, and enamel. The gloss and enamel varieties are preferable where predictable conditions indicate frequent washing and water exposure. These paints are suitable for surfaces exposed to severe moisture conditions from outside the concrete. They frequently will blister if water comes from or through the concrete. Enamels, which are much harder than gloss paints, are definitely to be preferred for use on floors under traffic.

Rubber-base paints generally consist of only resin pigment, solvent, thinner and plasticizer. Unlike other paints they are characterized by a rapid rate of drying and hardening which relies almost com-

pletely on the evaporation of organic solvent and thinners. The main advantage of rubber-base paints is their outstanding alkali resistance. They are usually low in solids content, resulting in thin films unless multiple coats are applied. Shower stalls, washrooms and laundry rooms are suitable indoor applications.

The solvents in rubber-base paints are normally more unpleasant than those in other paints. Ventilation must be good when they are applied. They are more easily applied by spray than by any other method.

Water-thinned paints. In contrast to the rubber and epoxy types, these paints are relatively easy to work with. They can be thinned with water and all equipment is easily cleaned with water. A few years ago water-thinned paints were more or less classed in the whitewash category, with a durability (particularly a scrubbing resistance) of about zero. Today they are largely based on a rubber latex.

These latex water-thinned paints have excellent washability. Their resistance to abrasion is, however, low and they are not therefore suitable for use on floors. A particularly good application for these paints is on the interior surface of below-grade basement walls; they are alkali resistant and at the same time breathe, thus minimizing hydrostatic pressure build-up behind the film. They are widely used successfully on all interior wall painting. They are easily applied with a roller coater. A minor disadvantage is that the paints can be damaged by freezing.

Bituminous paints. These are the outstanding waterproofing agents where appearance is not a factor; i. e., you can have any color you like as long as it's black. Bituminous paints are based on either coal-tar or asphalt, and can be supplied as solids to be melted for hot application, or liquids for brush application. The liquid varieties are reduced with thinner or emulsified with water for normal application. Where a high degree of waterproofing is desired several applications of these materials should be used, building up in layers and reinforced if necessary with lapped fabric or felt. Built-up layers with fabric membrane have the advantage that should fine cracks develop the coating will still tend to maintain its continuity.

Epoxy paints. The new epoxy resins, which are so successful in concrete construction as adhesives, are also formulated into paints. They are characterized not only by extreme chemical resistance but also by exceptional hardness, flexibility and adhesion—properties which make the epoxies of particular value whenever abrasion and impact resistance are the main problem. The epoxy paints are supplied in many different formulations. One type requires the addition and mixing in of a catalyst or curing agent immediately before use.

SURFACE PRETREATMENT

As a general rule it is best to delay painting a new concrete surface as long as possible; the drier and more seasoned the concrete, the less chance of subsequent trouble. With all paints other than the cement-water type, impounded moisture invariably leads to blistering and peeling to some degree. Recommended minimum delay for paints containing drying oils is 6 months and for the alkali-resistant types 2 months.

A surface treatment which is not strongly recommended, but which allows immediate painting of freshly-stripped concrete should this be unavoidable, consists of spraying the surface with a neutralizing solution of 3 percent phosphoric acid and 2 percent zinc chloride. The solution should be allowed to dry for 24 hours and the surface then brushed clean of any reaction salts before painting. It must be pointed out that the results of such a treatment are at best only temporary, since the neutrality obtained cannot resist the flow of alkaline moisture from the main mass of the concrete.

The usual requirements with regard to the removal of foreign matter from the surface to be painted also apply with concrete. All loose material that can cause loss of adhesion must be removed. Dirt, dust and efflorescence can be sandblasted, brushed or washed away depending upon the extent of the contamination. Grease, oil and traces of old paint can be scrubbed off with a solution of lye. Form oil can also be a problem and should be carefully removed. Heavy deposits of efflorescence which resist normal treatment should be washed with a solution of muriatic acid (one pint to a gallon of water). Acid treatment, or mechanical roughening, for example by means of a light sandblast, is recommended for extremely dense, glazed surfaces to give the paint a good key. Concrete cast against steel forms may also require this treatment. Whenever lye or acid is used a thorough final rinsing of the surface is essential to remove all traces of the reaction products and unreacted residues of these chemicals. During application goggles and protective clothing must be worn.

With old or very porous concrete, the use of grout may be necessary to obtain a smooth surface prior to painting. A 1:1 cement/mortar-sand grout is recommended for small pits and flaws and a 1:3 grout for larger holes and cracks. The areas should be thoroughly wet before grouting; the mortar should be damp wet only and should be packed firmly into place. Curing for 3 days after the mortar has set, by frequent water spraying or covering with wet burlap, is recommended.

Before painting is started it is a good idea to make sure that all flashing, hangars, trim or other fixtures are in position and watertight. Touching up of damaged areas, besides being uneconomic, invariably leads to color differences. MORE

Recommended Usage, Characteristics, and Properties of Paints for Concrete

GENERAL TYPE	APPLICATION			SPECIAL CHARACTERISTICS	METHOD OF APPLICATION	DELAY BEFORE PAINTING	COVERAGE	DRYING/HARDENING TIME
	Outside Walls	Partition Walls	Floors					
Cement-water	Above grade. (Exterior)	—	—	Can be applied to damp surfaces.	Scrubbing. Spray for decorative purposes only.	More or less immediate.	1 pound dry powder = 25 sq. ft.	Allow 24 to 48 hours between coats. Paint stiffens in 3 to 4 hrs.
Oil-base	Above grade. (Exterior)	—	—	Subject to "chalking".	Brush, spray, or roller.	6 months	1 gallon mixed = 150 to 500 sq. ft.	24 to 48 hours.
Varnish-base	Above grade. (Interior Only)	Recommended	Recommended when not in direct contact with subgrade.	Grades of flat, semi-gloss, or full-gloss.	Brush, spray or roller.	6 months	1 gallon mixed = 600 sq. ft.	Overnight
Lacquer-base (Solvent thinned)	Above grade. (Exterior)	—	Recommended	Alkali-resistant. Can be used where concrete will be damp.	Brush, spray, or roller.	2 months	1 gallon = 500 sq. ft.	1/2 to 4 hours.
Water-thinned	Above grade. (Exterior & Interior) — Below grade. (Interior Only)	Recommended	—	Alkali-resistant. Ease of thinning and equipment cleaning. High moisture transmission.	Brush, spray, or roller.	2 months	1 gallon mixed = 500 to 600 sq. ft.	Overnight
Clear (Silicones)	Above grade. (Exterior)	—	—	High penetrating. Water repellent.	Brush or spray.	6 months	1 gallon mixed = (first coat) 100 to 500 sq. ft. (second coat) 400 to 800 sq. ft.	Overnight
Bituminous	Below grade. (Buried Surface)	—	—	Direct application. Excellent waterproofing.	Brush, spray, or trowel.	More or less immediate.	Solid: 1/16 in. thick per coat. Liquid: 1 gallon mixed = 100 to 300 sq. ft.	Overnight to 3 days, depending on surface and application conditions.
Reactive coatings (Epoxies, Urethanes, and Polyesters)	Okay, but too expensive for use below grade.	Recommended	Recommended	Excellent as general chemically resistive materials with very low moisture transmission rates.	Brush, spray, or roller.	Not over 28 days.	150 to 300 sq. ft. average	Recoat after 6 hours.

PAINT APPLICATION

All paints even though they may seem to be homogenous should be stirred thoroughly before use by pouring back and forth a few times between two containers. Thinning of paints is always a tricky business and the manufacturer's instructions should be followed carefully. Thinning beyond the manufacturer's recommendation results in excessive penetration and increased cost. It is particularly important to use the proper thinner with lacquer and varnish type paints which contain materials which are compatible with only certain thinners and solvents. The application of a mixture improperly thinned can result in a perpetually tacky goo which will cost a small fortune to remove. Tinting is also difficult, and again should be done according to the manufacturer's instructions.

Painting, like concreting, is best done under favorable climatic conditions. Some lacquer paints can be applied satisfactorily at freezing temperatures, but generally the air temperature should be above 50 degrees F. Good drying conditions should prevail for all paints except the cement-water type. At warm temperatures the paint will flow better, giving better penetration of the surface. The method of application, whether spray, brush, or roller, is not particularly important, and should rest to a large extent on economic considerations. Regardless of the method of application, it is important that the paint fill and seal the wall; for this reason it may be desirable in all cases to apply the first coat with a brush or by spraying. This does not normally apply to cement-water paints which should be scrubbed into the surface using a stiff bristle brush; spraying is however possible for decorative purposes. With any paint, brushing has the advantage that it works the paint thoroughly into the surface. When spraying, care must be taken that protrusions do not mask any areas. Varying the angle at which the gun is held will avoid this.

Good workmanship is as important in painting as in any other job. A full uniform film should be applied without letting the paint sag. This is important since many complaints of paint defects can be traced to the fact that the painter has simply not put enough on. With protective painting one-coat jobs should always be avoided; it is impossible to guarantee a paint coat of a full uniform thickness over the entire area in one application. For interior painting, where decorative rather than protective considerations are paramount, thickness of coating or number of coats is not important provided proper hiding is obtained.

Rates of application and drying times vary considerably depending on a number of factors—not only type of paint but also surface conditions and temperature. Representative figures are quoted in the table as a general guide. For a very rough surface the coverage quoted can often be reduced by as much as half for a first coat. It is good practice to apply alternate coats in slightly contrasting colors, for this practice provides an additional guarantee of complete coverage.

THE FINAL EFFECT

With good workmanship and a good quality material, a paint finish chosen for the correct application should prove both visually and economically satisfactory. A knowledge of some of the faults may however save a few headaches later.

Loss of adhesion, blistering, peeling. This is usually due to water pressure behind the film or the presence of efflorescence, again caused by moisture. The source of the water must be removed, or if this is not possible an alkali-resistant paint, or some form of water barrier, must be used. Improperly prepared surfaces may also be the cause of loss of adhesion.

Framing, mottling. These are terms used, often for block construction, to describe the pattern of lines or patches of discoloration which appear through a paint. Often the framing follows the mortar joints between blocks. The cause is alkali attack either from within the concrete or without. If the concrete was correctly seasoned and is not in a damp location, external exposure conditions should be suspect. Use of an alkali-resistant paint will normally solve the problem.

Wrinkling, alligatoring, checking are usually the result of uneven drying through the application of too thick a paint coat. The surface layer dries first, sealing the underlayer; as drying continues the underlayer contracts to cause disruption of the surface. The same effect can result from painting over a primer or preceding coat which has not thoroughly hardened. Thinning of a too-thick paint, or better still, a more energetic brushing out, will prevent these defects.

Mildew. The presence of mildew on a paint film is due to dampness in the atmosphere, probably coupled with inadequate heating and ventilation. A cheap method of removal is to scrub the area with a disinfectant made up of 1 ounce of trisodium phosphate and 1 ounce of sodium pentachlorophenate to a gallon of water. These are common chemicals and are safe to use. Many paint manufacturers now include fungicides in their products. Even with these, however, a mildewed area should first be sterilized before painting.

Careful selection and application of paint for concrete will not only save a lot of worry and money, but will insure an attractive finish. The key point to remember is that any paint which is known to be durable on wood or steel in any particular exposure will generally be equally durable on concrete. The most critical factor in painting concrete is surface preparation and aging of the concrete. END

THE CONCRETE INSPECTOR

AT THE RISK OF TOUCHING OFF some heated debates, Concrete Construction in this article has attempted to set down some general rules concerning the proper activities of that most frequently misunderstood and abused functionary of the construction business: the concrete inspector. No one seriously questions the need for careful inspection of construction work in general, and of concrete work in particular. Both life and property are likely to be at stake in even the simplest structures, and the construction industry as a whole is keenly aware of the heavy responsibilities attendant upon its operations.

Most responsible contractors inspect their own work for shortcomings and errors regardless of whether it is subject to scrutiny by others. The builder's own financial interests, his responsibility to his customer, and his obligation to protect the safety of the public—all these considerations argue for careful inspection procedures as a matter of simple routine. For this reason, then, these comments are directed mainly toward the self-scrutinizing type of concrete inspection activity rather than the strictly professional variety, even though it is recognized that the two have very much in common.

FILE: Supervision

Let's start with forms. When should they be checked and what should the inspector look for? Forms should be checked as they are being built and also after they are in place. They should be tight, true to line and dimensions, and well tied and braced. Column and wall forms should be checked with a plumb bob. One authority has this to say: "Sometimes the wood spreaders that are used between vertical forms for walls are carelessly removed so that they fall into the wet concrete and are lost, or are perhaps not removed at all. To prevent such accidents, it is good practice to run a wire vertically through holes in the spreaders, tying the wire to the bottom spreader. The wire should not be centered with respect to the wall, so that when the concrete reaches the proper height a pull on the wire will dislodge the bottom spreader. Each spreader in turn may be dislodged as the concrete is poured to the proper height, and the inspector may be assured that no spreader is left in the concrete."[1]

Forms should be cleaned out at the bottom before concrete is placed. All paper, shavings, snuff

1. McKaig, T. H.: Field Inspection of Building Construction, F. W. Dodge Corp., New York, 1958, Chapters 1 and 7.

boxes and other foreign material should be removed, usually through cleanout holes, and the forms flushed out. A careful check should be made to insure that all chamfer strips, small offsets, sleeves, and so forth are in place as called for on the plans. There can be no compromise with forms, because every defect in them will show up in the finished structure.

What about the reinforcing steel? The grade of steel should be as specified, and a check should be made of this since some specifications do not permit the use of hard grade or rail steel. Sample bars should be cut—with a hacksaw, not a torch—from each size bar in the shipment and submitted to a laboratory for testing. Reinforcement should be free from loose scale, rust and grease. While mill scale can be seriously detrimental, a little rust does no harm; grease and oil, however, are definitely objectionable.

The proper placing and tying of reinforcement steel is of the utmost importance.[2] There is no excuse for an inferior job of installing bars, because it's so easily done right the first time. Metal chairs and spacers are standard today; they are easy and inexpensive to acquire and should be used wherever possible.

For inspection to be fully effective, the inspector should be on hand to observe carefully the handling and placing of the concrete from start to finish. The proposed details of these operations are usually worked out with the superintendent during the time the forms are being made ready, so that approved methods are used to the satisfaction of everyone concerned. Every effort should be made to prevent segregation of the concrete on its way into position. It should go vertically through downpipes at the ends of chutes or conveyor belts. Hoppers should be filled by receiving the concrete centrally over the bottom, not against the sloping sides. The ACI Building Code sets forth excellent methods in this regard. The height from which concrete may be dropped should be limited, and this height reduced if observation shows segregation occurring. Concrete should be deposited as near its final position as possible, in layers, and as rapidly as is consistent with good workmanship after it has been mixed. Vibration of the concrete should be done properly by an experienced workman. Vibrator should not be held in one place too long, should not penetrate too far into a lower layer of concrete, and should not touch the reinforcing steel. A spare vibrator should be available in case the one in use fails to function.

Depending on the magnitude of the project, the inspector may make the required test cylinders (or beams if it's a paving job). He may also make the control tests required, which are for air content, yield, and consistency. This last, the simple old reliable slump test, usually will verify what his experienced eye has already told him; that the slump is within the specified range.

Proper inspection of concrete work always demands careful attention to the important details of joints. Expansion joints should be and are usually completely detailed on the plans, and these details should be followed exactly when the joint is installed. Normally construction joints should not be left up to the discretion of the contractor. They should be properly and adequately made and have a keyway incorporated. They should be correctly located: in floors at or as near as possible to points of minimum shear; in walls near the midpoint between columns and, if possible, at the corners of a window; and in pavements at least ten feet from the preceding transverse joint.

A good inspector will be particularly insistent that the concrete be promptly and properly cured. In cold weather, forms should be closed in and the enclosure kept heated to 70 degrees F. for three days, or as otherwise specified. At all other times, the concrete should be kept damp or wet the specified length of time. It is of prime importance that a first-class job of curing be done to secure the highest quality concrete possible.

The keeping of accurate and up-to-date records is an essential responsibility of the concrete inspector. Daily reports, test reports, progress reports, change orders, and so forth can usually be handled best with standardized forms. There is also much to be said in favor of keeping a personal job diary, recording in it such items as important happenings, verbal instructions, disputes, important visitors, personal comments and so on. Bound surveyors' field books are fine for this purpose. The diary may be of inestimable value in case of future disputes or litigation.

So much for just a few of the literally countless things that a concrete inspector must be on the alert for, regardless of whose payroll he is on. But what about the man himself? What attributes should he bring to his job?

Most builders will agree that a good concrete inspector will be soundly and thoroughly grounded in both the theory and practice of quality concrete construction. This is no job for the neophyte or for the man who isn't interested enough in the art of concrete to study it constantly and keep himself thoroughly up-to-date on current developments.

In the final analysis the habit of observation is probably the most important tool in the concrete inspector's whole bag of tricks; without it all the information in the world will not enable him to successfully and completely discharge his responsibilities. For it is literally true that an effective concrete inspector adds in every hour of every work day to the fund of knowledge and information which he brings to his exacting and challenging job. END

2. See "Placing Reinforcing Bars," Concrete Construction, March 1960, page 67.

FLOATING BOX FOOTINGS

. . . speed bridge construction

A PROMISING TIME-SAVING TECHNIQUE has been developed in the construction of the new $14,000,000 Benicia-Martinez Bridge in Northern California. The method involves floating, reinforced-concrete boxes, 44 by 86 by 25 feet, which are cast on dry land, launched like ships, and towed to the bridge site by tugs and then anchored in place.

Then 6-foot diameter steel caissons up to 143 feet in length are lowered through cells in the concrete boxes to the bottom of Carquinez Straits. Filled with concrete, these caissons provide legs to support the box footing; the boxes are themselves eventually filled with concrete to serve as the foundations for the concrete bridge piers. The steel truss bridge will extend across the Straits supported on ten such piers.

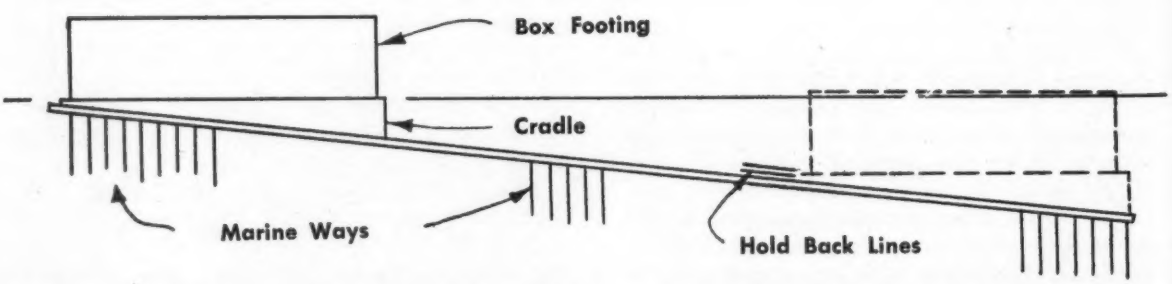
It is believed that the experience gained on this project will exert considerable influence on the design and construction of future deep-water piers of concrete where physical conditions are similar. Each concrete footing is partitioned into 18 cells, making a buoyant, honeycombed box. Ten of the cells have 84-inch steel pipes extending from the bottom to above the water line.

In the construction the footing is first securely anchored into position and 6-foot steel caissons are then lowered through each of the 10 steel, 80-inch pipe sleeves. The caissons are then sunk to bedrock, 130 feet below mean sea level.

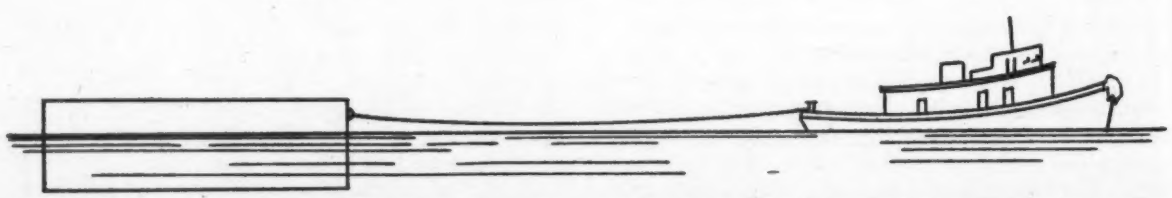
To sink the 6-foot diameter steel caissons into bedrock the construction crews first lower a temporary 80-inch diameter casing into the water. The next step is to lower a 78-inch rotary drill and air lift pump into the temporary casing and to drill and pump out the material down to bedrock and two feet into it. At this stage the 78-inch drill is replaced with a 62-inch drill for another 5 feet of drilling into the bedrock.

If the rock is sound, the drill is removed and the 72-inch diameter steel caisson is lowered into place at the bottom of the 78-inch diameter hole. The drilled hole 5 feet below the caisson is then cleaned and inspected by a deep sea diver to insure a solid rock footing and a clean hole for the concrete.

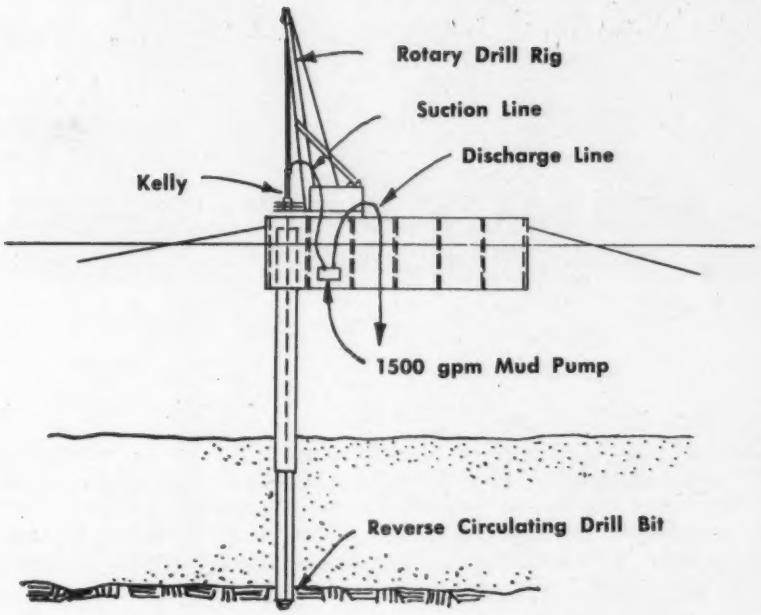
A reinforcing steel cage is then placed in the bottom and concrete is placed up to the footing block. A minimum of 40,000 cubic yards of concrete will be used in the substructure of the bridge.



(1) Step one consists of casting a reinforced concrete box footing, honeycombed with 18 cells. After proper curing of the concrete, the footing is launched down the marine ways into the bay.



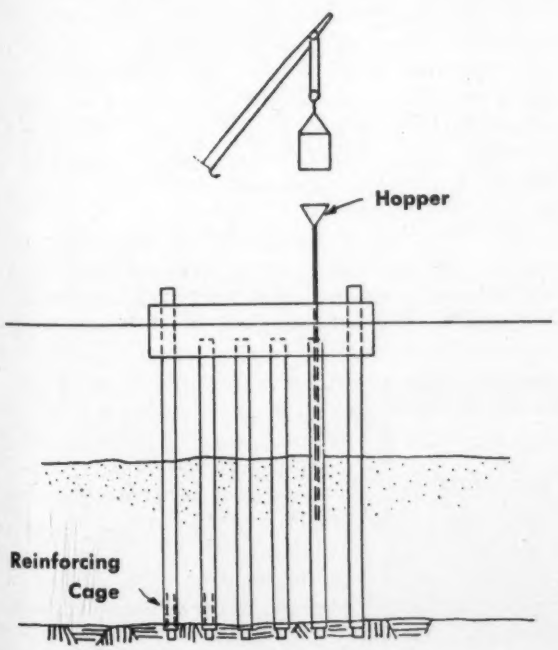
(2) The box is towed approximately 30 miles to the bridge site. The footing weighs about 1700 tons and has a draft of 14 feet. Over-all dimensions of these sections are 44 by 86 by 25 feet.

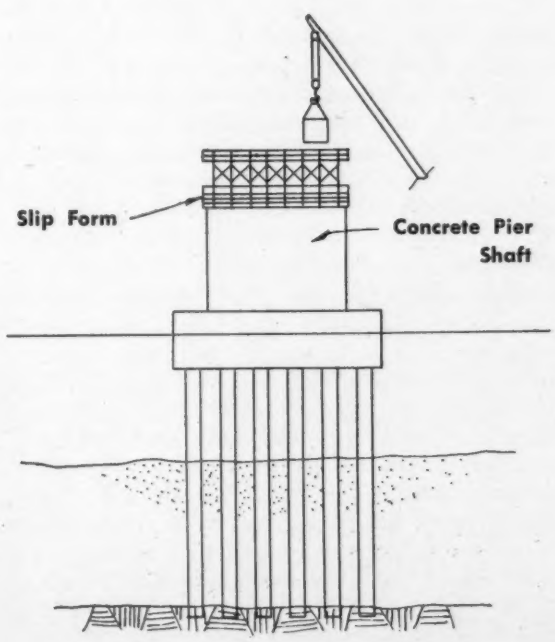


(3) The floating box is anchored in place by four to six 6-ton Danforth anchors, after which 80-inch temporary casings are placed. Through these casings a 78-inch drill is positioned and driven by a rotary drill rig at the top. The drill bores a hole through the overburden and 2 feet into bedrock, while an air-lift pump removes the cuttings. A 62-inch drill is then used to bore an additional 5 feet into bedrock.

(4) The permanent 72-inch steel caissons are placed. The load of the footing is now transferred to the four corner caissons. This is done by placing heavy steel beams with hanger rods across the corner caissons at high tide. As the tide goes out the load of the concrete box footing comes to rest on the four caissons.

(5) When the caissons and the box footing concrete work are completed, a 12-inch concrete slab and the base of the concrete shaft are cast over the top. The concrete shaft is cast by the slip form method and will extend above the footings to a maximum of about 130 feet to form the support for the steel truss shoes.





PLUS SERVICES WITH MANUFACTURED FORMS

BY D. M. DECANIO*

ENGINEERS AND CONTRACTORS who have never really analyzed or compared contractor-built wood forms for concrete forming with the several manufactured forms now on the market may be amazed at what currently available manufactured forms have to offer in the way of reducing forming costs. Free engineering service, both office and field, as offered by the manufacturers is not a gimmick or a wild claim. The premise that a product is successfully sold only when it's successfully used has been responsible for the development of form manufacturers' engineering services. Although manufactured forming systems are simple to use, problems do rise and field service as offered by the manufacturer should be requested. Usually, after the engineer or contractor becomes familiar with a manufactured system the request for field service is rare.

Manufactured forms may be bought or are available on a rental basis with the same engineering services offered. The skeptics who may be convinced that the cost of the engineering services is hidden in the purchase price or rental fee for the forms can easily prove for themselves what economies in forming time can be effected by utilization of manufactured forms and the help of the manufacturer's field service men on their next jobs.

Office engineering services are more complex than field services. Working from a set of plans supplied by the contractor, the form manufacturer will analyze the forming requirements. The basic information that the contractor or engineer will receive includes: (1) total form contact area in square feet; (2) total square feet of forms required and the sizes of the forms; (3) specific area in which forms are to be used; (4) rental period within which form work can be completed; (5) number of times forms can be reused; (6) number of ties required; and (7) amount of lumber required for alignment and bracing.

This information is also supplied with a total material cost based on what the manufacturer would furnish together with any recommendations that he feels would be of help in reducing costs or speeding up the forming operation.

Some contractors and engineers may believe that their experience in forming eliminates the need for help from the manufacturer. However, those who are reluctant to avail themselves of information that is offered without charge or obligation may be surprised how a brief discussion or exchange of correspondence may prove valuable. No one engineer or contractor could possibly gain the experience of the manufacturer who has worked on thousands of projects of all types. On the other hand, the manufacturer has learned a great deal from the many engineers and contractors with whom he has worked and his respect for their ideas and suggestions has been of great value in helping to achieve rapid, accurate and economical concrete forming techniques which are available to all. This exchange of ideas and experience can thus benefit everyone concerned with good forming practices.

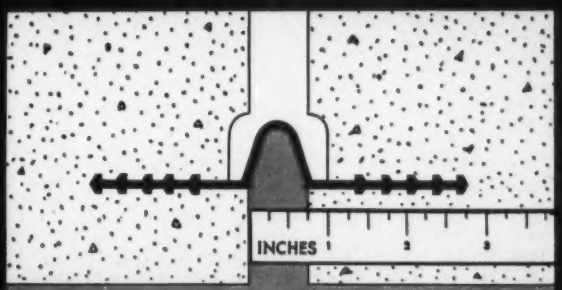
On a job which called for forming 9,000,000 square feet of contact area and required over 500,000 cubic yards of concrete, hundreds of individual drawings were supplied to the contractor. Approximately 350,000 square feet of manufactured forms were used with completely satisfactory results. To be sure, such an undertaking called for teamwork — engineers, superintendents, contractors, and engineers from the form manufacturer worked closely together to see that the many structures—large, small, complicated and simple —were formed to maintain rapid job progress. Whether the job calls for forming 9,000,000 square feet of contact area or 900, the form manufacturer is ready to help. END

*Vice President, Engineering, Universal Form Clamp Company

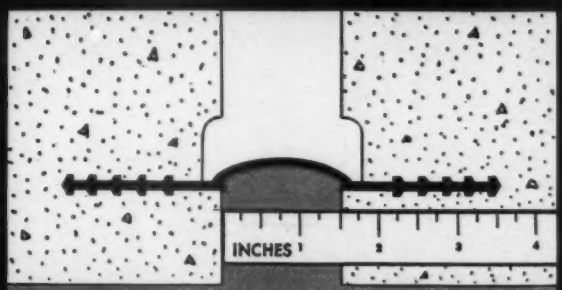
NOW . . . A WATERSTOP DESIGNED TO HANDLE ELONGATION CORRECTLY . . . WITHOUT STRESSING THE MATERIAL OR MULTIPLE-RIB AREA!

SEALTIGHT®

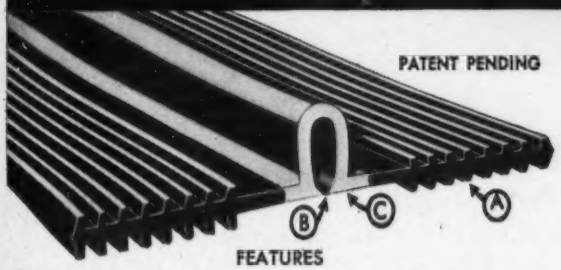
DUO-PVC WATERSTOPS



Notice how the U-Bulb design permits the waterstop to mechanically expand without stretching the material or stressing the multiple-rib area. The DUO-PVC material maintains correct thickness and the ribs remain firmly embedded in the concrete to stop water.



During tests conducted at the University of Detroit the joint was opened 1½" and the DUO-PVC waterstop was subjected to a 100 foot head of water . . . *no leakage occurred* . . . also a 215 foot head of water was applied . . . again *no leakage occurred*. Tests also proved tremendous advantage of the exclusive Sealtight rib design. Copies of test results available.



FEATURES

(A) Exclusive rib design offers greater holding power, strength and rigidity. The rigid ribs will not compress, shear-off or pull-out.

(B) Exclusive thin membrane prevents infiltration of concrete during pouring . . . designed to tear under expansion and allow U-bulb to accommodate extreme expansion.

(C) Exclusive U-bulb design mechanically expands 1½" without stretching material or stressing rib area . . . when greater expansion occurs the DUO-PVC material will then accommodate it safely.

. . . the first waterstop designed to accommodate expansion without impairing the basic function of the waterstop!

Sealtight DUO-PVC Waterstops are simultaneously extruded from two top-quality PVC compounds. The PVC utilized in the center area is compounded to combine strength with maximum flexibility, whereas, the multiple-rib area is extruded from a PVC compound that offers great strength with a desirable rigidity. This new concept of waterstop design permits DUO-PVC Waterstops to effectively function as a waterstop while safely accommodating expansion movements heretofore thought impossible. Mail the coupon below for complete information.

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More than a year and a half in preparation, our NEW Handbook is now completed and ready for distribution. This Handbook, which we believe to be the most comprehensive ever to be compiled, has been prepared in twelve sections, each dealing with a Richmond product category or a phase of concrete construction. Whatever your concreting needs, you will find a Richmond product in this Handbook which will be completely suitable for your particular application.

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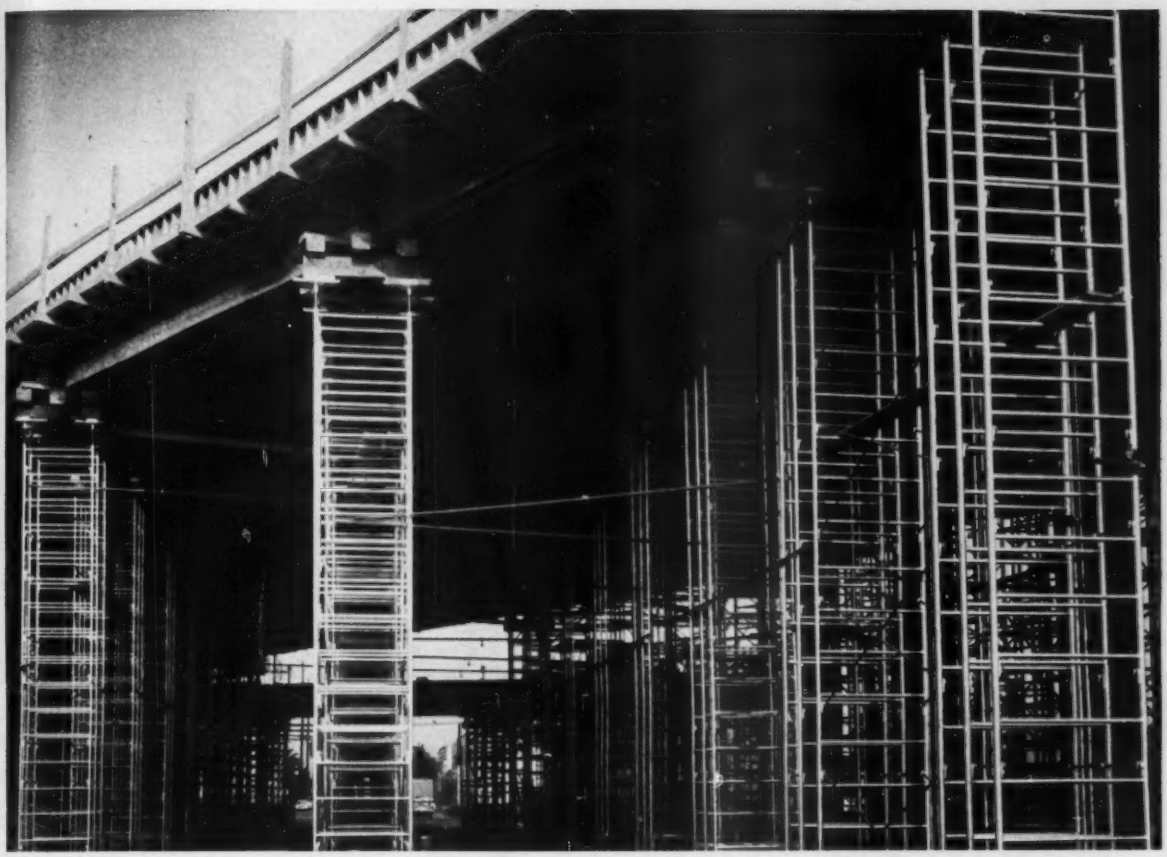
gain in prestressed bridge authorizations

Recent figures released by the U.S. Department of Commerce, Bureau of Public Roads, Bridge Division, for new bridge construction in 1960 indicated an increase in the number of prestressed concrete bridges authorized for construction. The bridges are classified as reinforced concrete, steel, and prestressed concrete and further as bridges for primary, secondary, urban and interstate highways. Of particular interest are the figures for interstate bridges authorized in 1960: 392 prestressed interstate bridges in 1960 against a total of 648 prestressed bridges during the three previous years. The number of prestressed bridges authorized with respect to the total increased to 16.7% in 1960 from 13.6% in 1957-58-59, while the percentage of total cost decreased from 13.4% in 1957-58-59 to 11.1% in 1960. This is indicative of the economy of prestressed concrete bridges; even though more were used they actually commanded a smaller portion of the total cost. Percentage figures for the number of bridges on all types of highways also indicate an increase in the use of prestressed concrete. The figure jumped from 9.7% in 1957-58-59 to 12.3% in 1960, also with a decrease in percentage of total cost of from 11.9% in previous years to 11.0% in 1960. The states which led the parade with prestressed concrete bridges were Pennsylvania with 83 bridges in 1960; Texas with 56; California and Michigan with 50 each; Florida 37 and Wisconsin 35.



New Heavy Duty 20K Frames Shore 6-mile Freeway Access

BY MOVING a minimum amount of equipment only 19 times, the contractor, Griffith Company, is able to save considerable material costs on shoring work for the six mile Santa Monica viaduct section of a connecting Freeway near Los Angeles.

The design of the job involves a heavy concrete box girder system. To provide adequate support for this construction, PS Co.'s new heavy duty 20K "Trouble Saver"® Shoring frames are used. 9000 of these frames shore a section 850′ long by 65′ wide. Lift trucks move this same shoring equipment to adjoining sections of the same size. In this way the work is accomplished with minimum material.

Weight of the concrete box girders can be realized from these details: bottom slab is 5½″ to 6½″ thick; top 5″ to 5½″ thick; box depth is 4′ to 5′ and made in three pours. Overall viaduct height varies from 15′ to 33′. A total of 13,900 20K frames was used on this project.

20K FRAMES of "Trouble Saver" Shoring are designed for heavy duty work in accordance with PS Co.'s high standards of safety and are tested under simulated field conditions—and proved on recent jobs, like this one—to safely support up to 10,000 lbs. on each leg. Frames are 4′ wide, in 3′6″, 5′ and 6′ heights. Legs are 2⅜″ o.d. U-heads, sprockets, adjustable legs, base plates can be arranged in any manner, top or bottom. For complete details, write for Bulletin PSS-51.

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Here's an Idea!

GAR-BRO helped cut costs in pouring concrete piers!

One contractor cut the time in placing concrete on this bridge job by planning ahead. Here, on these two bridge piers, note that he used three complete units comprised of Gar-Bro Collection Hopper and a string of Steel Chutes plus a Gar-Bro Bucket. He used the hopper and chutes to direct the concrete into the forms and prevent segregation.

His object was to prevent any delays by using one hopper and chute unit to place concrete in one pier, while the second one was set in place in the other pier, and the third one (see it hanging in rack between piers) was being shortened. Delays of transit mixers and the crane were minimized by rotating the hopper and chute units and shortening the chute line to the new level of the concrete in each pier.

It's a good idea to team up your Gar-Bro Concrete Handling Equipment to save time and cut costs.

See your Gar-Bro dealer or write for Catalog and Concrete Handling Manual today!

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The World's Most Complete Line of
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repair material

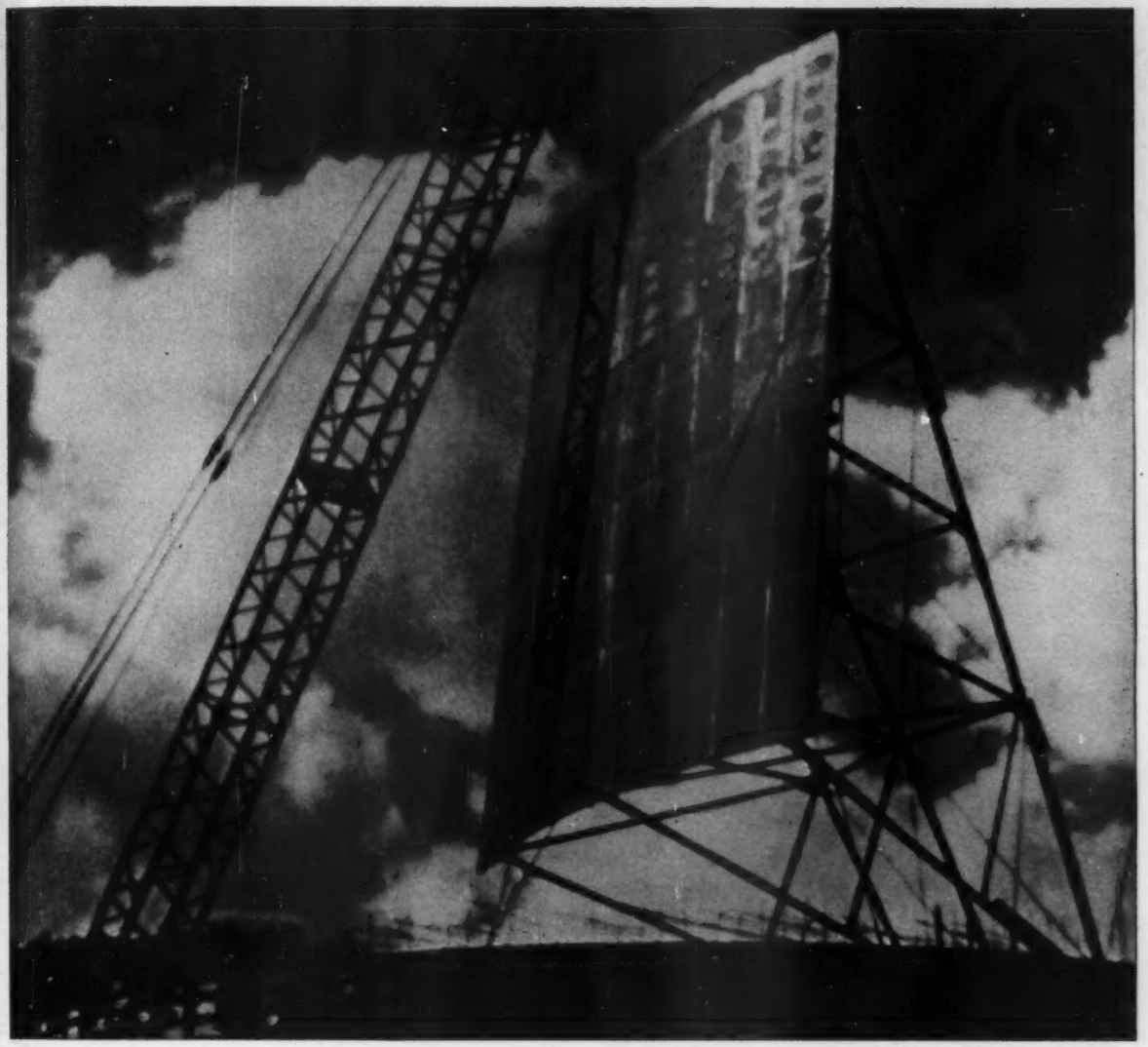
A one - component dry - mix cement compound for concrete finishing and patching requires only mixing with water before troweling on. It is said to be ideally suited for thin toppings to concrete slabs, for repairing concrete floors, steps, ramps, sidewalks, driveways, and swimming pools. It does not oxidize, craze, get brittle or disintegrate and is non - toxic, non - fuming, non - caustic, vermin-proof and nonflammable, according to the manufacturer. Larsen Products Corp., Bethesda, Md.

form coating

An application of two coats of Burke Form Coating is said to deposit a hard film on raw plywood forms which presents a glass-like surface to the poured concrete. Unlike glass or most plastics this film does not shatter or become brittle with age. Panels treated with this formula produce clean concrete surfaces after many pours. Burke Concrete Accessories, Inc., 2690 Harrison St., San Francisco, California.

grinding concrete

Many specifications are now calling for finely finished concrete surfaces on all types of structures including highway structures and prestressed concrete beams. Bulletin 5922 gives complete information on the proper accessories and speeds for both wet rubbing and dry grinding on various jobs. Information on the proper equipment for finishing hardened concrete walls is given as well as for finishing concrete floors and ceilings. There is also a section on grinding prestressed concrete beams. Stow Mfg. Co., 354 Shear St., Binghamton, N.Y.



4 Ton Ganged Section, 22 Ft. by 28 Ft. Used for . . .

28′ High Circular Walls of Sewage Plant

Friebel & Hartman, Shelby, Ohio contractor, was able to strip and reset 2,300 square feet of forms on the inside gang section in 3½ hours. A ¾ yard crane with an 80′ boom handled the sections. 8 men in less than 8 hours erected 2,300 square feet of forms and scaffolding on the outside, plus pouring the concrete. The project was the Mansfield, Ohio Sewage Treatment Plant, which consisted of four digestors, each 80 feet in diameter, 28 feet in height and 8 inches thick with no horizontal joints.

Four ganged sections were used—each 22 feet wide and 28 feet high. This allowed pouring ⅓ of a tank at a time, and a pour every four working days. Weight of each ganged form section was about four tons. By using three trusses to brace each ganged section contractor was able to hold bracing costs to a minimum.

Complete story on the Ohio Sewage Treatment Plant will be sent *free* upon request. Symons Steel-Ply Forms can be rented with purchase option.

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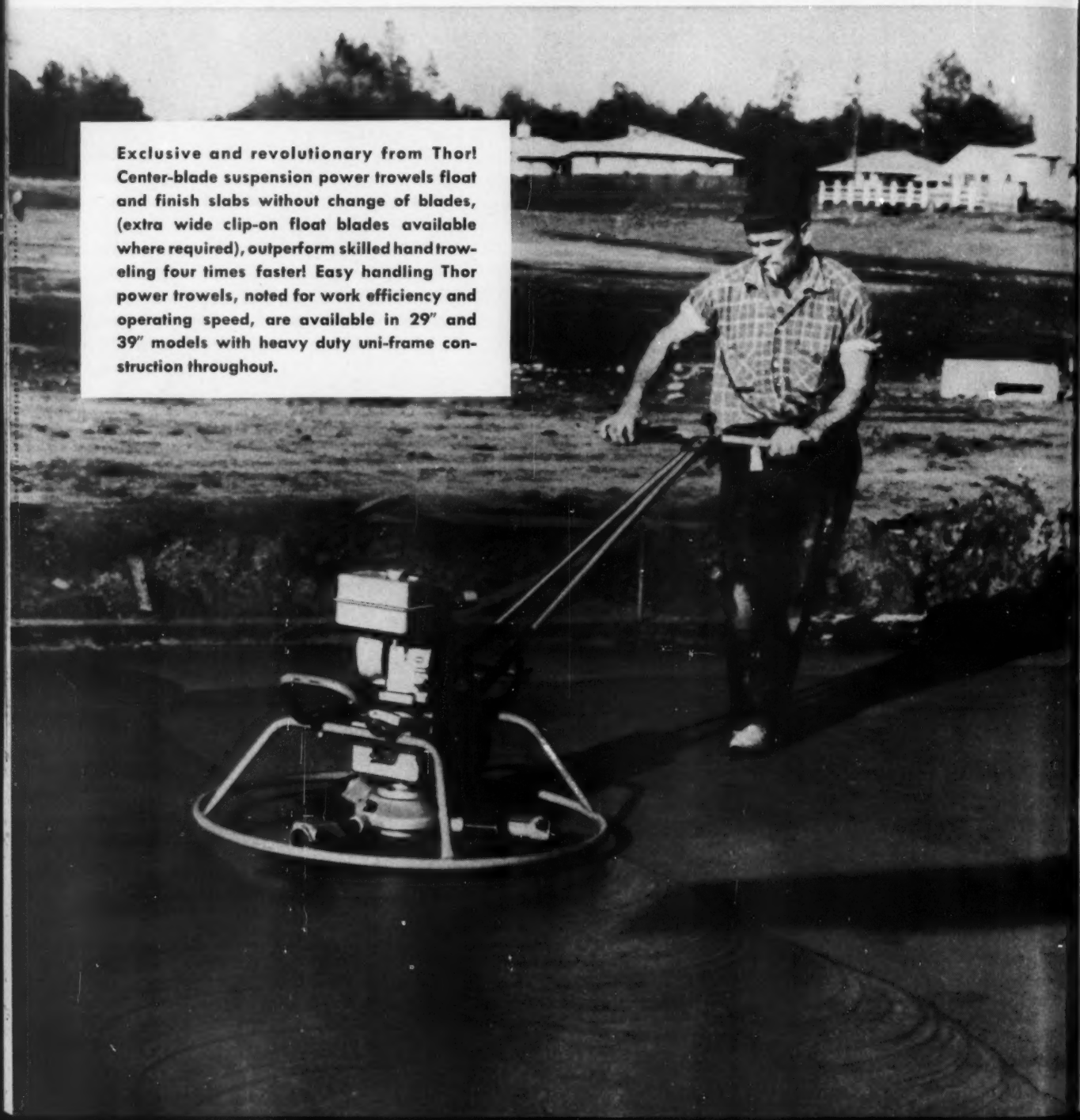
Power Trowels and Screeds...the winning combination that finishes first and finest

THOR CONCRETE CONSTRUCTION TOOLS



Exclusive and revolutionary from Thor! Center-blade suspension power trowels float and finish slabs without change of blades, (extra wide clip-on float blades available where required), outperform skilled hand troweling four times faster! Easy handling Thor power trowels, noted for work efficiency and operating speed, are available in 29" and 39" models with heavy duty uni-frame construction throughout.

Modern concrete placing and finishing operations require modern equipment to complete them. That's where Thor's power pair comes in—revolutionary "StraPaction" screeds and exclusive center-blade suspension trowels. Lets you strike off, compact and vibrate drier, stiffer, economical mixes with unusual ease and efficiency. Also discover Thor's lightweight, economical vibrators and generators for faster and finer results at less cost to you. See your Thor distributor in the Yellow Pages. Or write Thor Power Tool Company, Aurora, Illinois.

BETTER CONCRETE FINISHING IN LESS TIME. This 29" trowel with non-rotating guard ring protects the operator, permits work closer to walls, utility outlets; gets jobs done quicker, more efficiently. Can be carried through standard door openings for basement work.

THOR VIBRATORY FINISHING SCREEDS feature exclusive "StraPaction," lightweight and low initial cost. Require no special rails or forms. Choose from models 4' to 30' —for operation speed-up and reduction of production costs.

THOR'S COMPLETE LINE of 1 h.p. electric flexible shaft vibrators are available in 4 small head sizes (1", 1¼", 1½", 1¾"). Powerful CV3 Motor-in-head vibrator (with 2⅜" head) leads all competition in providing high speed vibration in the stiffest mixes. 5 operator hose lengths.

FOR EASY TRANSPORTATION in heavy duty field service, this Thor 4½ h.p. GHV gasoline engine flexible shaft vibrator with self-contained Briggs-Stratton 4-cycle engine can be mounted on sturdy wheel-barrow. Vibrator has 2⅜" head, shaft lengths to 30 feet. Also available, new 4 h.p. electric flexible shaft vibrator, delivers 10,000 to 12,000 vibrations per minute.

THOR PORTABLE GASOLINE ENGINE GENERATORS furnish all the necessary power for tools, lights, electric vibrators. 1500 watt set shown, also 2500, 3000 watts available.

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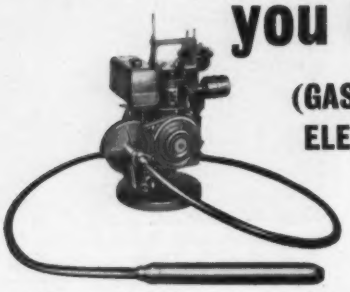
Thor POWER TOOLS

Concrete Vibrators—the Remington line offers you more models!

(GASOLINE, AIR, ELECTRIC POWERED)



7,000 vpm and 10,000 vpm—5¼ or 6¾ hp, gasoline

Model 7GV and 10GV—V-belt pulley drive gives 3,600 to 10,000 vpm. 360° swivel base or wheelbarrow mount.

10,000 vpm—1 hp, electric

Model 1EV — 115 volt, ac/dc. Weight with 2-ft. shaft only 23 lbs. Shafts up to 14 ft. Handy switch.

3,600 vpm—3 hp, gasoline

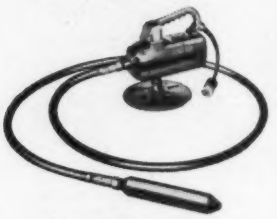
Model 36GV — Low-cost, versatile unit with many applications. Choice of heads: 1⅞" or 2⅛" diam. head. Swivel base.

10,000 vpm—1½ hp, electric

Model 2EV — 115 or 230 volt, ac/dc. Weight, 27 lbs. with 2 ft. shaft. Shafts up to 14 ft., 1¼", 1⅞" and 2⅛" diam. head.

10,000 vpm—1¾ hp, air

Model 2PV — 10,000 vpm at 90 psi. Operable by one man. Built-in oiler, handy throttle. Choice of heads: 1¼", 1⅞" and 2⅛" diam. head.

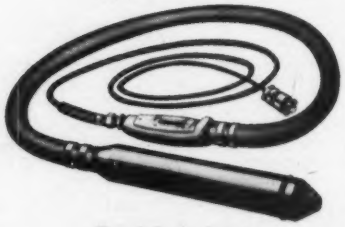


10,000 vpm—2 hp, electric

Model 3EV — 115 or 230 volt, ac/dc. Capacity, 35 cu. yds. of concrete per hour. Choice of heads: 1⅞", 2⅛" or 3¼" diam. head.

10,000 vpm—3½ hp, air

Model PV-24 — 10,000 vpm at 90 psi. Heavy-duty motor with automatic oiler. Head: 2½" diam. head. Weight only 30 lbs.



Motor-in-head—electric

Model EV26—115 volt, ac at 25-60 cycles. 2⅝" diam. head with built-in motor. Thermal overload switch prevents burnouts.

Remington has the most complete line of vibrators on the market—gasoline, air and electric powered...and most shafts, heads and accessories are interchangeable from model to model. This means you can get big savings if you standardize on Remington concrete vibrators.

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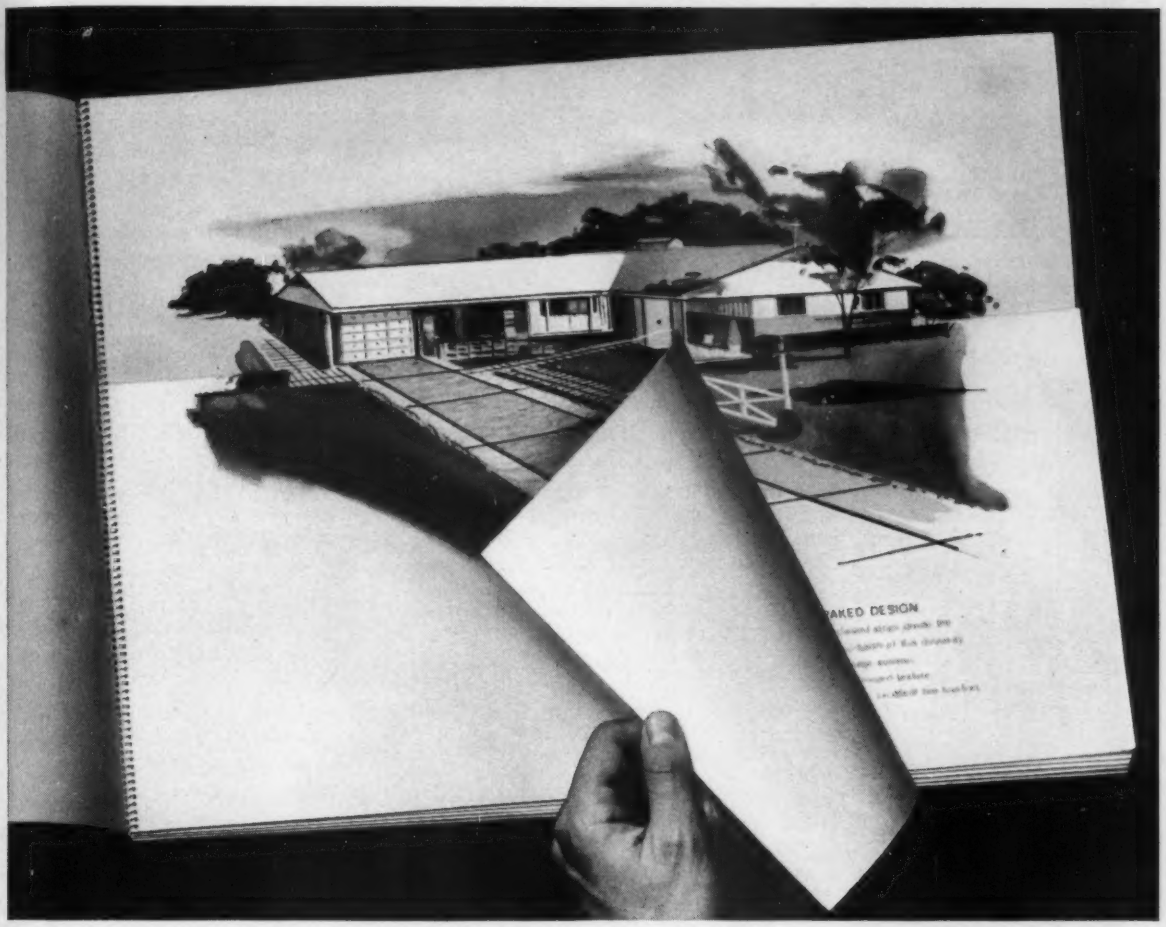
Unbreakable voice gun weighs only 3¼ pounds and is a self-contained public address system consisting of microphone, transistor amplifier, speaker and power supply, all in one unit. Simple to use and operate, it answers the needs of supervisors on construction jobs. It is designed to function equally well in summer heat and sun, in rain and in sub-zero cold. Operates instantly, without warm-up. William A. Holmin Corp., 1212 Eleventh St., Rockford, Ill.

portable sandblaster

A new portable sandblaster has been recently introduced and marketed. This portable sandblaster will quickly clean dried cement, rust, dirt or paint from ready-mix trucks and construction equipment, leaving a clean, dry etched surface that provides an excellent bond for new paint. Completely portable, the unit is 29 inches high with a tank diameter of 6 inches, weighs 24 pounds, and has an abrasive capacity of 28 pounds of sand. The sandblaster features a squeeze grip abrasive delivery nozzle, a pressure gauge and pressure relief valve, a built-in funnel for filling, and a high strength delivery hose of double braid construction. Handi-Blast Div., Hamill Manufacturing Co., Washington, Mich.



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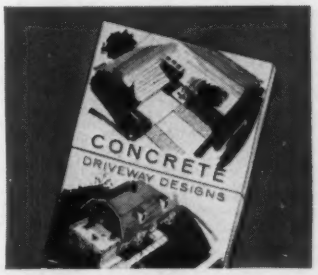
Sell modern "custom designs" and you'll sell more concrete driveways. This big full-color book, "*Concrete Driveway Designs*," will make the job easier. Prepared by Portland Cement Association, this demonstration book has what it takes to excite the interest of homeowners—to win orders for custom-designed concrete driveways.

Put this book down before your prospect's eyes. Every flip of the ingenious die-cut pages presents a new idea. He'll see textured designs, geometric patterns, exposed aggregate surfaces, ribbon and patio block combinations—and a whole array of color possibilities. Only with *concrete* are such imaginative, custom-designed driveways possible! Start now to line up prospects for new driveways.

FREE! Write for copy of "Concrete Driveway Designs" for use in selling to homeowners. Additional copies available at low cost. (U. S. and Canada only)



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A national organization to improve and extend the uses of concrete

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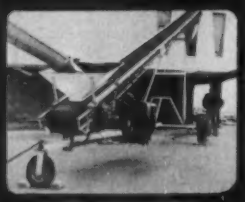
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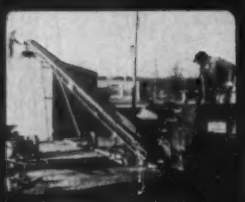
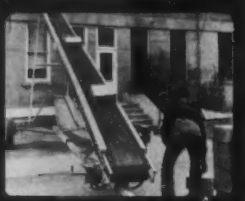

SAND, GRAVEL

BRICK, BLOCK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What ONE Conveyor Handles All These Materials?

Here's the belt conveyor designed from scratch for the building contractor. It elevates and bridges over or under obstructions almost any material you can place on the belt.

The Morgen Pan-Type Hydraulic Drive Belt Conveyor supports the load-carrying belt on a special steel pan that provides a trough in the center for bulk materials and flat edges for solid materials wider than the belt.

Morgen hydraulic drive conveyors are designed to eliminate service problems and damage by operator negligence. The direct coupled hydraulic drive is completely adjustment free. Head pulley drive increases efficiency and prolongs belt life. Balanced design lets Morgen build a heavy duty conveyor that is light enough to be moved about the job easily, even with the boom at maximum elevation.

No wonder contractors call it the most versatile low-cost material handling equipment on the market today!

Fully portable conveyors discharge at heights up to 33′, reach 27′ beyond rear wheels and cover horizontal distance of 47′.

CONCRETE CAPACITY 30 YARDS PER HOUR

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PAN-TYPE HYDRAULIC DRIVE BELT CONVEYOR

Built to Take Care of Itself!

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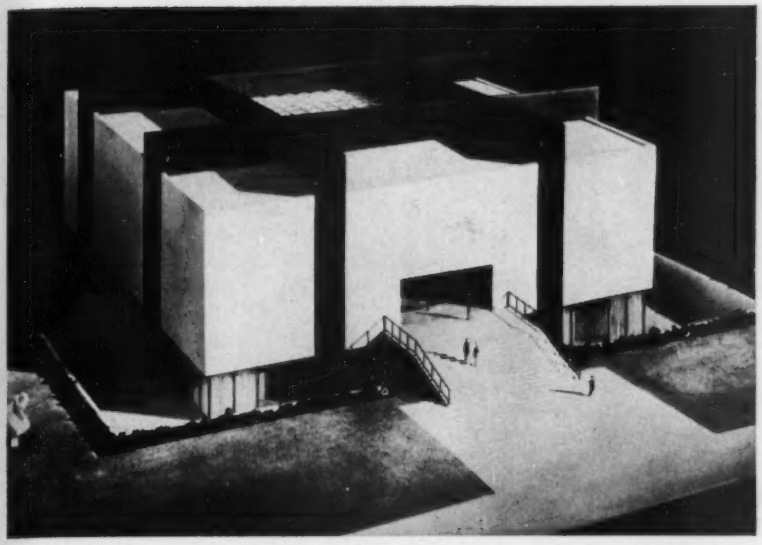
Makers of MORGEN ADJUSTABLE SCAFFOLDING and SELF-TRAINING IDLER ROLLER CONVERORS

products

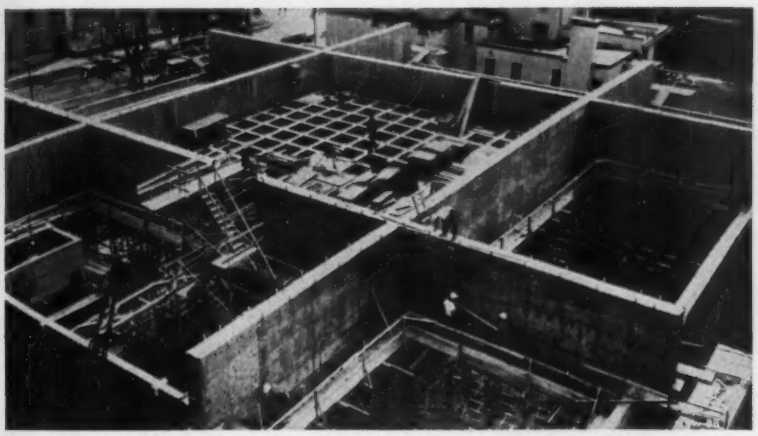
emergency oxygen

Accident victims on remote construction projects will stand a better chance of survival as the result of a new plan called the Voluntary Mobile Emergency Oxygen Dispensing Station Movement.

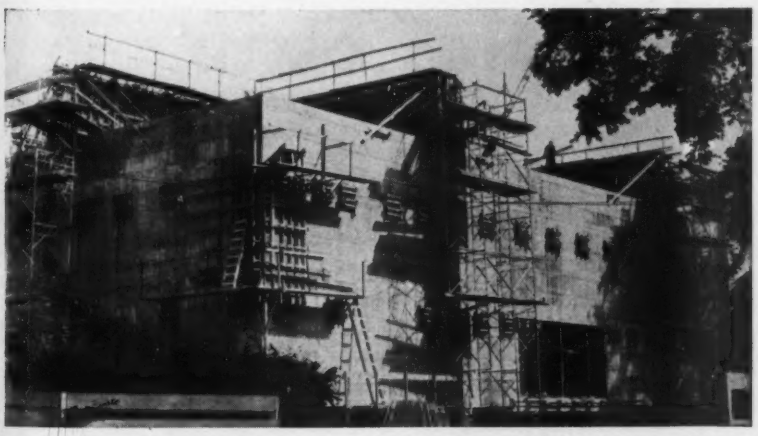
Under this program emergency oxygen will be available on highways across the country. This important advance in life saving was made possible by the development of a small portable oxygen tank that can be stored in automobiles or trucks. Streamlined and lightweight, it is always ready for use. Its simplified controls eliminate the old-fashioned valves, gauges, re-breather bag and heavy cylinder traditionally associated with administration of oxygen. More than 20 gallons of medically pure oxygen are compressed into each grapefruit-sized sphere. Sponsorship of the volunteer humanitarian group has been undertaken by the firm which developed the portable unit. For additional information write Breath-O'-Life Oxygen, The Arcade Building, Cleveland 14, Ohio.



INVERTED-T's, 129″ deep with 22″ webs and 34″ flanges, form two-way lattice roof girder system for Munson-Williams Proctor Institute, Utica, N. Y Girders were post-tensioned after two weeks, when concrete had reached 4,000 psi. Each girder carries 14 tendons, each composed of 25 ¼″-dia. wires.



12 CAST-IN-PLACE 50″ ribs form coffer in 57 sq. ft. central bay. Plexiglass domes will admit natural light to gallery. This section was cast monolithically with the roof girders. Girder mix weighed 144 lb. per cu. ft. The rest of the superstructure was formed with lightweight concrete, 110 lb. per cu. ft.



EXTERIOR WALL-GIRDERS, 31′ deep and 11″ thick, are supported on columns. They cantilever 30′ beyond the columns to corners. Contractor, George A. Fuller Co.; Consulting engineer, Lev Zetlin; Architect, Philip Johnson Associates, all of New York City.

Concrete control is key to unique roof girder system

SPECIALLY DESIGNED ready mixed concrete, poured monolithically over 16 hours, was the key to the ingenious roof girder system of this column-free art gallery. Four interlocking, inverted-T roof girders support both the 117 sq. ft. roof area and a 30′ wide balcony, hung 18′ below. 31′ deep concrete wall-girders cantilever 30′ beyond eight exterior columns to provide exterior support for roof, balcony and main floor framing.

The 350 cu. yd. continuous pour, specified to avoid construction joints, called for a special concrete mix that would reach 5,000 psi at 28 days, have slow initial set, good workability and rapid development of creep. Another requirement was slump variation from 3½″ to 2½″ to assure uniform setting.

Shrinkage cracks were controlled by leaving open 3′ x 20′ diagonal strips at the corner of each floor and 3′ wide corner sections in the walls. These were poured two months later, after most shrinkage had occurred.

From 8 a.m. until midnight, 22 cu. yd. of precisely mixed concrete were delivered each hour by truck mixers of certified design, capacity, mixing speed and water control accuracy.

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Darex Diary

by Mel Prior
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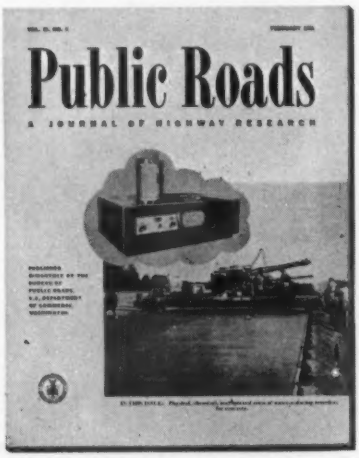
Technical Service Manager, Construction Chemicals
GRACE W. R. GRACE & CO./ DEWEY AND ALMY CHEMICAL DIVISION
Cambridge 40, Mass. • Chicago 38, Ill. • San Leandro, Calif. • Montreal 32, Canada

(No. 21 of a series)

Bureau of Public Roads' Water-Reducing Retarder Report

BY COINCIDENCE, this issue of Darex Diary is number 21; same as the code number for Dewey and Almy's DARATARD in the Bureau of Public Roads' recently published study of water-reducing retarders.



The February, 1961 issue of Public Roads was devoted to physical, chemical and spectral tests of water-reducing retarders for concrete.

The members of the Bureau's Division of Physical Research are to be congratulated for planning, organizing, and conducting this series of tests, as well as for an excellent presentation of the test data. The work is a valuable contribution to the knowledge of admixture use in concrete, and an excellent guide for specification writers.

The twenty-five admixtures submitted for testing by the Bureau can be divided into three basic groups: Lignosulfonates, Organic Acids and Carbohydrates. It is interesting to note that these three groups had widely varying effects on the properties of the resultant concrete. Furthermore, individual admixtures within each group had significantly different effects on the properties of the admixtured concrete.

Retardation is the prime consideration in any specification for water-reducing retarders, and should be determined according to ASTM Designation C 403 before investigating other properties. The effect of the retarder on water reduction, strength, durability, and shrinkage of concrete should also be thoroughly investigated. These factors have a bearing on the over-all quality of the admixtured concrete and all should be considered by the specification writer.

In the Bureau's symposium, DARATARD placed easily within the requirements of the recommended specification for water-reducing retarders, and ranked high on the list among all admixtures tested. From a completely impartial standpoint, the Bureau's report points up the wide difference in lignins, with DARATARD being among those showing the most desirable properties. This underscores the important point that the results obtained with any one lignin should not be taken as indicative of the performance of all. The BPR specification offers a good basis for proper evaluation.

products

new steel reel

A new packaging method has been developed for use with prestressed concrete strand. The strand is shipped to the prestressed fabricator who uses a take-apart steel pay-off reel of the same outside dimensions as the standard wood reels. Increased lengths per package save replacement time. After assembling, the package is handled the same as wood. Roebling's Construction Mat. Div., Trenton 2, N. J.

rotary core bit

The material used on the cutting edge of this bit cuts through reinforced concrete, steel rod, steel plate, wood, asphalt, tar, brick or any other masonry materials, saving time and money as some of these materials previously had to be cut with hand or air-operated hammers and chisels. The cost of drilling is said to be less than half that of diamond core bits. Designed for use in New England Carbide Core drilling machines, the bits may also be used in any diamond core machine that can be modified to produce the correct rpm, driving power and pressure. Sizes start at 1½ inch to 6 inch diameter, and the tip is easily removed for tip inspection and re-sharpening. New England Carbide Tool Co., Medford, Mass.

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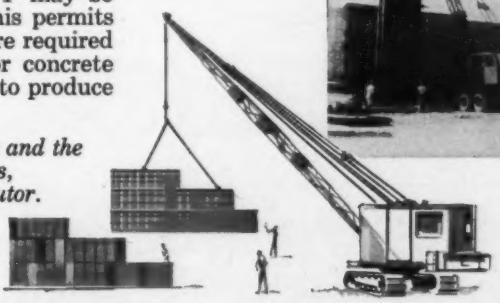
For complete information on UNI-FORM Panels and the UNI-FORM System in crane handling operations, write today, or ask your nearby Universal Distributor.



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green concrete sawing blade

A new reinforced concrete sawing blade is available in widths to make 3/16", ¼", ⅜", and 7/16" wide cuts. Blade breakage is said to be virtually eliminated by placing two layers of reinforcing through the center of the blade, then adding two additional layers of reinforcing at the hub. Field tests have been said to produce as much as 25% more blade life with no sacrifice in speed when sawing a wide range of "hard to soft" limestone aggregates, steel mill slag, as well as aggregates with percentages of granite. Clipper Mfg. Co., 2800 Warwick, Suite 124, Kansas City 8, Mo.

sectional steel shoring

Frames of sectional steel shoring are used to support this complicated 1-foot to 5-foot thick cantilevered concrete roof system of sloping planes and hyperbolic paraboloids. The shoring makes free standing, level units to meet varying heights. Adjustable screw legs are used top and bottom, with U-heads at top to receive stringers. Pictured: St. Mark's Episcopal Church, New Canaan, Conn. General contractor, Frank Mercedes & Son; Sherwood, Mills & Smith, architects. Write: The Patent Scaffolding Co., 38-21 12th, Long Is. City, N. Y.

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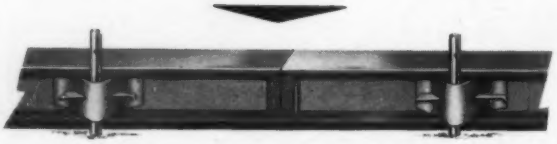

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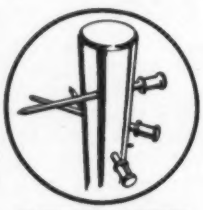

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Buffalo Crushed Stone is one of the leading material suppliers in the greater Buffalo area and western New York State. It sells ready mix concrete, sand, gravel, concrete pipe, precast and pre-stressed concrete members, crushed stone and bituminous concrete through three sales divisions.

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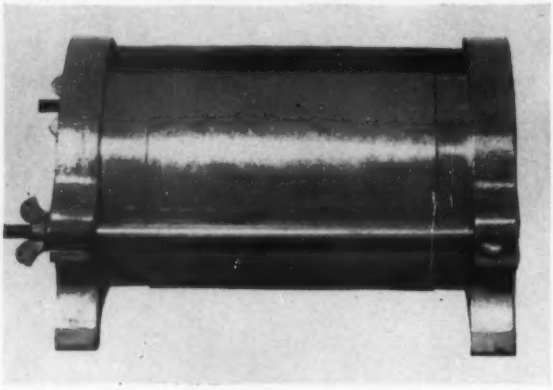
form extension angle

Contractor on a feed mill project avoided build-up forming and cut down on the use of fillers by using regular 2- by 6-foot Symons panels with one-foot form-extension angles attached to the top of the forms to cast a wall 6½ feet high. Angle is positioned in the slot of the end and attached with standard form hardware. To this angle, regular plywood is cut to size and nailed. Angles enable forming of walls of any height, and are applicable on projects not involving much repetitive work. Symons Clamp & Mfg. Co., 4249 W. Diversey Ave., Chicago, Ill.



cylinder mold

This horizontal cylinder mold is designed to produce test cylinders with perfectly square and plane ends so that for quality control and detensioning purposes, the entire capping procedure can be eliminated. The unit consists of a split steel barrel and two end plates, held together by two tie rods. A handle is provided for ease in carrying. The mold is filled through the slot on top and rodded in the usual manner. The opening also serves as an aggregate gage in that it prevents the entry of pieces that are too large. When the concrete has set, the end plates are knocked off, the barrel expands to release the specimen. Forney's Inc., Box 310, New Castle, Pa.

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problem clinic

EDITOR'S NOTE

Early issues of Concrete Construction included a regular column called Questions and Answers which fell by the wayside mainly because there was just not enough time available to give it the close attention it demanded. In reactivating the department under the new and perhaps more descriptive name Problem Clinic, we are taking into account a marked increase in correspondence with readers concerning every day questions that come up in the field.

We hope more readers, stimulated by the brief discussions presented here, will send in questions which can be dealt with in future columns. We will also welcome and publish, when space permits, correspondence designed either to take issue with or to expand any of the information presented in the Problem Clinic.

retarder controls bond

Question: Is it practical to use a retarder to obtain selective bond between prestressing strands and the concrete in a beam?

Answer: A retarder called Lubabon has been developed for precisely this purpose. It enables the designer to locate the bond transfer point at any desired place along the length of the beam. In practice, of course, a material of this kind would be applied to the strands at the ends of the beam to prevent the development of excessive com-

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pressive stresses in the concrete. Allowable spans may in this way be increased by as much as 10 feet.

autogenous healing

Question: What conditions seem to favor the so-called autogenous healing of fractures in concrete?

Answer: The fractured parts should be kept damp and in close contact. The healing process appears to be somewhat similar to the initial process of hardening.

aggregate size

Question: Does the use of larger coarse aggregate in a mix tend to produce concrete of higher strength?

Answer: A recent report by the National Ready Mixed Concrete Association reached the following conclusions:

1. At a given water ratio, within the range employed in most structural concrete, smaller maximum sizes of aggregate will tend to produce higher concrete strengths than larger ones.
2. The larger sizes will require less mixing water and hence, for a given cement factor, will produce concrete of lower water-ratio than the smaller sizes.
3. The advantage of small aggregate in the water-ratio strength relationship may or may not be sufficient to offset the effects of its higher mixing water demand. It appears that optimum maximum size, so far as strength is concerned, will vary for different aggregates, different cement factors, different test ages and probably other conditions.
4. A realistic appraisal of the recent data for several different aggregates must lead to

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WM-6

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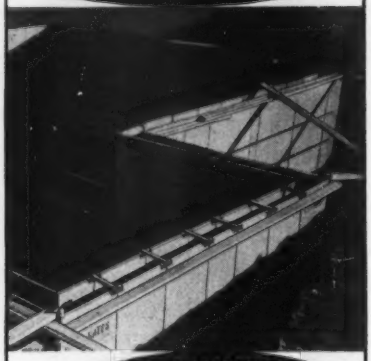

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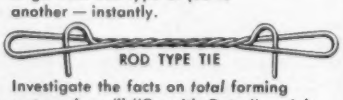

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the conclusion that size of aggregate, within a reasonable range, is of less importance to concrete strength than other aggregate characteristics. Even in the leaner mix, where the larger aggregate gave higher strength, the advantage was inconsequential in relation to strength differences between aggregates of the same size from different sources.

concrete temperature

Question: Can concrete temperatures be calculated in advance if the temperatures of the various materials are known?

Answer: Concrete temperatures can be calculated within reasonably close limits, using the following formula, in which the temperatures of the cement, aggregate and water are indicated t_c, t_a and t_w respectively:

$$t = \frac{t_c}{9} + \frac{t_a}{1.6} + \frac{t_w}{4}$$

flexural strength

Question: Is flexural strength testing a more reliable basis for accepting or rejecting concrete than compression testing?

Answer: Unfortunately flexural strengths determined from specimens molded and initially cured in the field show wide variations which have no bearing on the strength producing properties of the concrete. This seems to be largely a result of the extreme sensitivity of this particular test to the amount and distribution of the moisture in the specimen. For this reason it appears that flexural strength testing should be used mainly as a laboratory means for establishing proportions and evaluating ingredients, and *not* as a field procedure for determining compliance with specifications.

Money speaks louder than words.

—Bob Sproule

I FOUND THIS to be true when I called on Tom Hillman last week. Tom owns a concrete-products business, and I had tried plenty of words to convince him of the merits of calcium chloride. The words hadn't done much good, so I decided to try money this time.

I produced a quarter from my pocket, and asked Tom to do the same. Then I had him mix up a small batch of concrete, and pour half of it over my quarter. Next I took out a small bag of calcium chloride, which I had concealed in my pocket. I mixed the calcium chloride with the remaining concrete, and poured it over his quarter.

It was just about lunch time, so I invited Tom out to lunch. This was where I had to part with some real money . . . Tom is a pretty big eater.

When we got back about an hour later, I reached for my quarter. The concrete was about as stiff as a milk shake, and I had no trouble extracting the quarter. But when Tom tried to get his, he found that the concrete with calcium chloride had set solid!

Considering the lunch and all, I didn't exactly make a lot of money on the deal. But I did prove my point, which is that calcium chloride helps concrete set faster in summer. Wanna bet? *Wyandotte Chemicals Corporation, Wyandotte, Michigan.*

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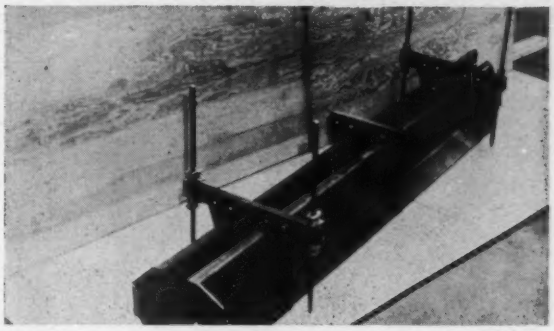
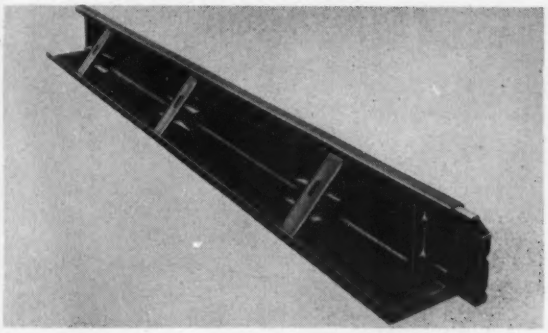
residential foundation forms

Savings of up to 50 percent in labor costs in residential foundation construction are claimed for this fiberglas curb wall form which features one-piece construction for fast erection and stripping, and joint and adjusting devices to eliminate special inside corner and outside forms and devices. Lightweight fiberglas is said to require less manpower for handling. Engineering assistance is available in form planning. Engineered Concrete Form Corp., 7658 S. Wentworth Ave., Chicago, Ill.





road forms

A line of road forms is manufactured in single or double wedge design with slotted stake holes for automatic alignment. Stake pockets are closed, thus eliminating concrete and gravel build-up, and all pockets are electrically welded to the form face and base. Form ends are cut at an angle to facilitate inside radius work and ¼-inch steel lock-joint plates assure maximum bearing surface and load transfer. Available with standard upturned flange or plain base. Chain Belt Co., Milwaukee 1, Wisc.

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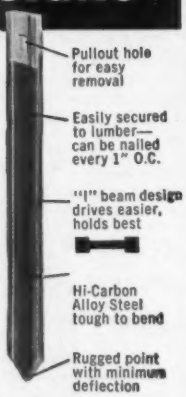
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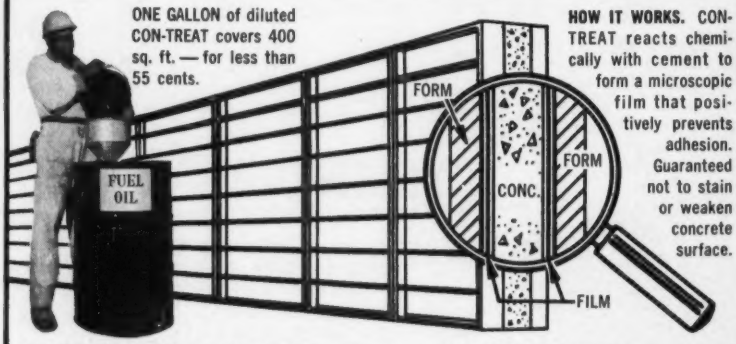
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